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## (54) Vehicle bumper assembly

(57) The assembly includes an elongated mounting beam 12 which serves as an integral part of the vehicle structure. An energy absorber 14 is connected to the mounting beam and is supported between two

tubular portions 22 forming part of the beam and extending along its length for providing structural rigidity and minimal deflection of the beam under impact loads. The mounting beam and tubular portions may be made from a single piece of sheet metal or from separate pieces of sheet metal welded together.

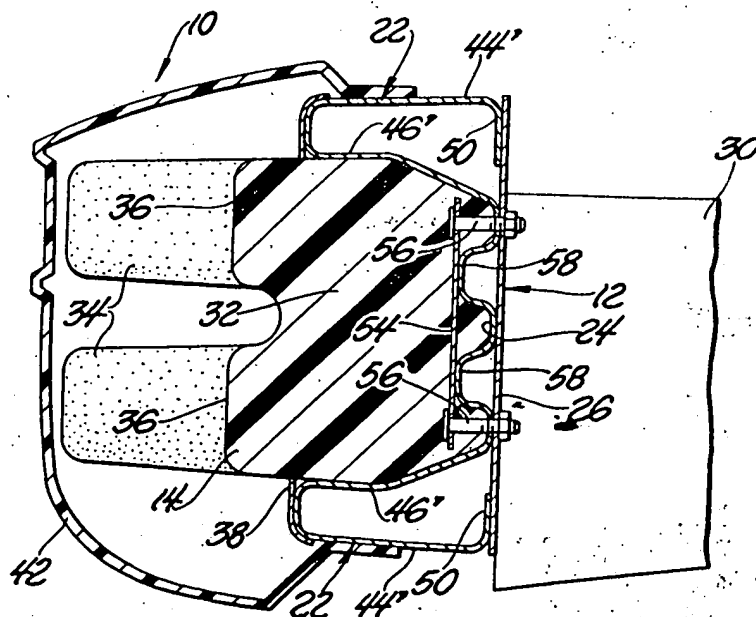
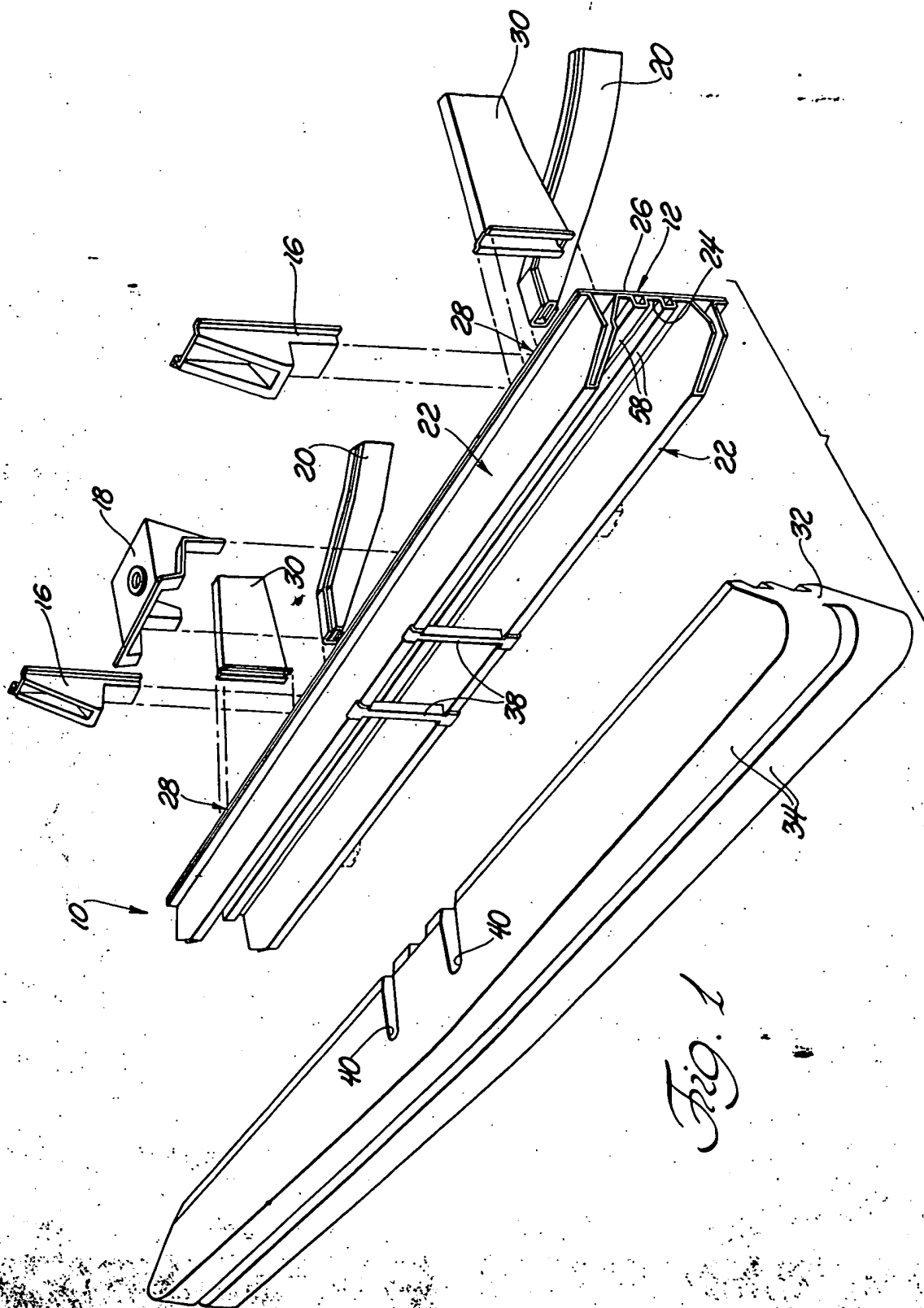


Fig. 2

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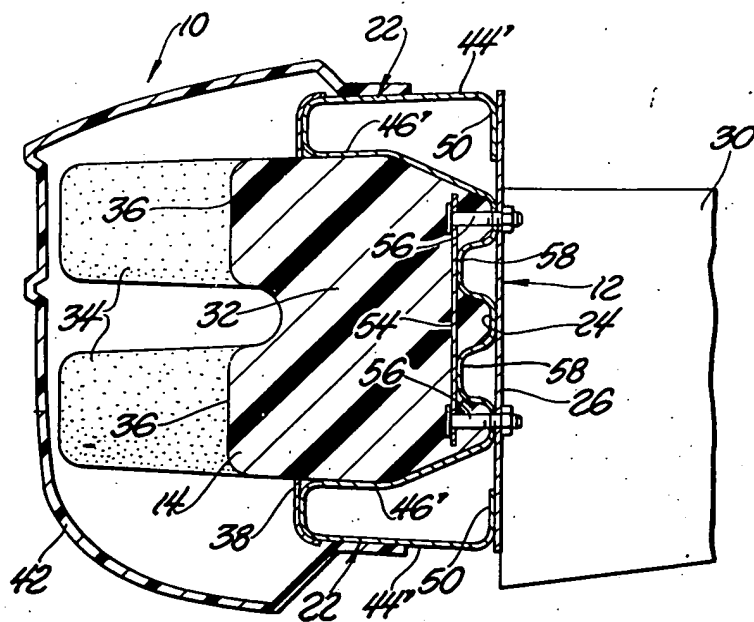


Fig. 2

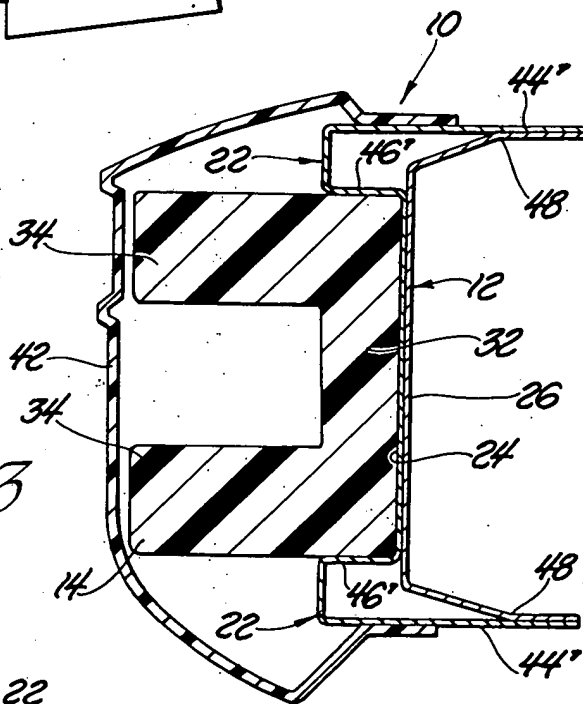


Fig. 3

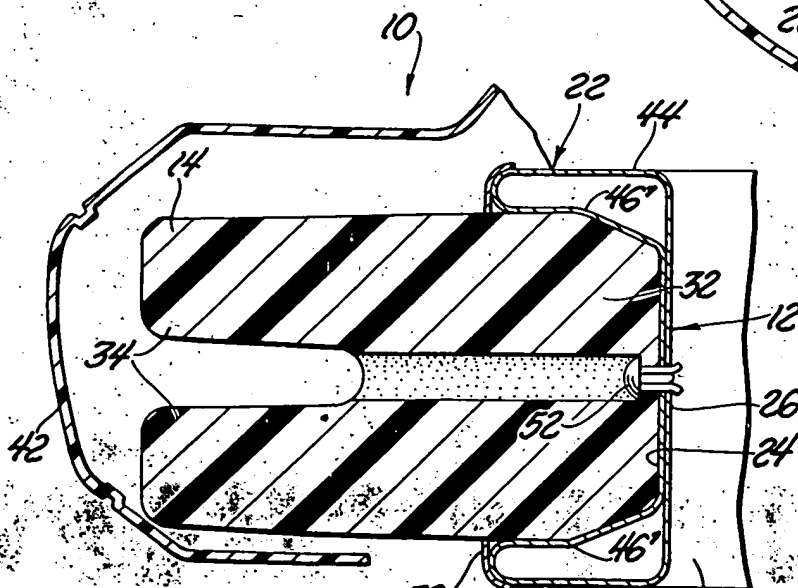


Fig. 4

# SPECIFICATION

## A vehicle bumper assembly

### Background of the Invention

#### (1) Field of the Invention

- 5 The instant invention relates to a bumper assembly for an automobile.

#### (2) Description of the Prior Art

- 10 In the automotive industry it is desirable to manufacture lightweight parts at a minimum cost. To accomplish this end with regard to the bumper art, manufacturers have designed various bumpers that are simple in design and include various structural reinforcements for providing additional deformation resistance.

- 15 A problem exists wherein prior bumpers require a standard reinforcement for supporting an elastomeric energy absorber. In other words, the prior art bumper assemblies are attached to a structure forming a part of the vehicle frame. This structure adds undesirable weight to the automobile. Also, prior art bumper structures include structural reinforcements which could not be adapted to be an integral part of the vehicle structure for supporting such structures as a hood latch or radiator mount, since those structural reinforcements of the prior art are not sufficiently rigid.

- 20 The instant invention solves the above problems by providing a lightweight mounting member adapted for being an integral part of the vehicle frame structure. The mounting member is constructed so as to provide maximum structural rigidity and deformation resistance.

#### Summary of the Invention

- 25 The instant invention provides a vehicle bumper assembly comprising an elongated mounting beam adapted for being an integral part of the vehicle structure and an energy absorber for absorbing impact energy. The energy absorber is connected to the mounting beam for support thereby. The assembly is characterized by the mounting beam including two vertically spaced and interconnected hollow, tubular portions. Each of the tubular portions has a closed cross section and extends along the length of the mounting beam for providing structural rigidity and minimal deflection under impact loads.

#### Brief Description of the Drawings

- 30 Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

- 35 FIGURE 1 is an exploded perspective view of the instant invention;

FIGURE 2 is a cross-sectional view of a first embodiment of the instant invention;

FIGURE 4 is a cross-sectional view of a third embodiment.

### Description of Preferred Embodiment

- 65 A vehicle bumper assembly constructed in accordance with the instant invention is generally shown at 10.

- The assembly 10 includes an elongated mounting means generally indicated at 12 adapted for being an integral part of the vehicle frame structure. In other words, as shown in FIGURE 1, the mounting means 12 functions as a cross beam for supporting an energy absorber 14 and also functions as a support for such vehicle structures as the radiator mounts 16, and the hood latch 18. The mounting means 12 can also include attachment means for attachment to the engine cradles 20. Therefore, the mounting means is an integral part of the vehicle frame structure for supporting other vehicle parts.

- 80 The assembly also includes an energy absorber 14 for absorbing impact energy. The energy absorber 14 is connected to the mounting means 12 for support thereby.

- 85 The instant invention is characterized by the mounting means 12 including two vertically spaced and interconnected hollow, tubular portions generally indicated at 22. Each of the tubular portions 22 have a closed cross section and extend along the length of the mounting means 12 for providing structural rigidity and minimal deflection under impact loads. This "dual box" structure has been found to be highly resistant to twisting in that under test conditions the "dual box" structure of the instant invention was found to reduce twist to twenty-five percent of that associated with prior art bumper structures. Therefore, the dual box construction provides maximum structural rigidity below the energy absorber 14 relative to the loading forces yet is relatively lightweight. This property of torque resistance allows the mounting means 12 to function as an integral part of the vehicle structure further reducing frame components and weight.

- 100 The mounting means includes a back portion consisting of two layers 24 and 26 of engaging sheet metal. The back portion extends between and interconnects the tubular portions 22. The energy absorber 14 engages the back portion and extends vertically between and engages the tubular portions 22. The energy absorber 14 extends away from the back portion forwardly beyond the tubular portions 22. Therefore, the energy absorber 14 receives most minor impact forces sparing the tubular portions 22 from impact and the resulting compression.

- 115 As previously stated, the mounting means 12 comprises formed sheet metal components defining the tubular portions 22 with two layers 24 and 26 of engaging sheet metal defining the back portion. The tubular portions 22 extend forwardly from the back portion.

As shown in FIGURE 1, the mounting means 12

adapted for attachment to the vehicle frame structure 30. The attachment means 28 may consist of holes in the mounting means 12 to which the frame members 30 are secured. The mounting means 12 has the required structural rigidity to compensate for the holes in the beam structure due to the reinforcing structure of the "dual box" construction. Additional holes may be made in the back portion of the mounting means 12 to reduce weight or as to function as attachment sites for the hood latch 18 or the radiator mounts 16. Therefore, unlike prior art cross beam constructions, the instant invention provides a mounting means 12 which is secured directly to the longitudinal vehicle frame members 30. Also, the structural design provides sufficient structural support and additional weight reduction.

The energy absorber 14 has a cross-sectional U shape defining a base portion 32 and two legs 34 extending therefrom. The base portion 32 of the energy absorber 14 is disposed adjacent to the first layer 24 of the base portion of the mounting means 12. As shown in FIGURE 2, the legs 34 may include reduced portions 36. The reduced portions 36 also extend forwardly beyond the tubular portions 22.

The bumper assembly 10 includes securing means for securing the energy absorber 14 to the mounting means 12. The securing means includes a plurality of strap members 38, as shown in FIGURES 1, 2 and 4. The strap members extend between the tubular portions 22 and are secured thereto. The strap members 38 secure the energy absorber 14 to the mounting means 12 and also provide resistance to compression forces which tend to separate the tubular portions 22.

The energy absorber 14 includes at least one recessed portion 40, as shown in FIGURE 1, extending at a distance equal to the forward extremity of the tubular portions 22 such that the strap members 38 extend through the recessed portions 40. As shown in FIGURE 1, the recessed portions extend inwardly from the back portion of the energy absorber 14. The energy absorber may be constructed alternatively such that the recessed portions extend inwardly from the outer portion of the energy absorber 14. These voids which define the recessed portions 40 may prevent bending of the strap members 38 upon impact compressing the energy absorber 14.

As shown in FIGURES 2, 3 and 4, the assembly 10 includes an elongated shell 42 disposed adjacent the mounting means 12 and about the energy absorber 14. The shell 42 is made from a resilient polymeric material and forms a part of the exterior of the vehicle. The energy absorber 14 comprises an elastomeric material which is adapted to absorb impact forces.

In a first embodiment of the instant invention shown in FIGURE 4, each of the tubular portions 22 includes a first leg 44 integral with the second layer 26 of sheet metal of the back portion and a second leg 46 integral with the first layer 24 of

of sheet metal comprising the back portion and two tubular members 22.

Two alternative embodiments of the instant invention are shown in FIGURES 2 and 3 wherein each of the tubular portions 22 includes a first leg 44' fixedly secured to the second layer 26 of sheet metal of the back portion and a second leg 46' integral with the first layer 24 of sheet metal of the back portion. As shown in FIGURE 3, the second layer 26 of sheet metal of the back portion includes a flange 48 extending from each end thereof. The first leg 44' of each of the tubular portions 22 is fixedly secured to corresponding flanges 48. In the embodiment shown in FIGURE 2, each of the first legs 44' of the tubular portions 22 includes a flange 50 extending therefrom. The flanges 50 are fixedly secured to the second layer 26 of sheet metal of the back portion. These embodiments are made from stamped sheet metal parts which are welded or otherwise connected together.

As shown in FIGURE 4, the securing means may include a tack 52 disposed within the base portion 32 of the energy absorber 14 and extending rearwardly therefrom. The back portion of the mounting means 12 includes holes therethrough, as previously described. The tack 52 extends through the hole and is secured to the other side thereof for providing additional securement of the energy absorber 14 to the mounting means 12.

An alternative construction is shown in FIGURE 2 wherein the securing means includes a plate member 54 disposed in the base portion 32 of the energy absorber 14. The plate member 54 has fastening means 56 extending through the energy absorber 14 for further securing the energy absorber 14 to the mounting means 12. The fastening means may consist of a bolt extending from the plate 54, the bolt being secured to the mounting means 12 by an appropriate nut.

As shown in FIGURES 1 and 2, the mounting means 12 may include integral ridges 58 extending longitudinally for providing additional structural reinforcement.

The invention has been described in an illustrative manner, and it is to be understood that the terminology which has been used is intended to be in the nature of words of description rather than of limitation.

Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims wherein reference numerals are merely for convenience and are not to be in any way limiting, the invention may be practiced otherwise than as specifically described.

## CLAIMS

1. A vehicle bumper assembly comprising; elongated mounting means adapted for being an integral part of the vehicle structure, energy

mounting means for support thereby, and characterized by said mounting means including two vertically spaced and interconnected hollow tubular portions each of said tubular portions

5 having a closed cross section and extending along the length of said mounting means for providing structural rigidity and minimal deflection under impact loads.

2. An assembly as set forth in claim 1 wherein  
10 said mounting means includes a back portion extending between and interconnecting said tubular portions said energy absorber means engaging said back portion and extending vertically between and engaging said tubular portions said  
15 energy absorber means extending away from said back portion forwardly beyond said tubular portions.

3. An assembly as set forth in claim 2 wherein said mounting means comprises formed sheet  
20 metal components defining said tubular portions with two layers of engaging sheet metal defining said back portion, said tubular portions extending forwardly from said back portion.

4. An assembly as set forth in claim 2 wherein  
25 said mounting means includes attachment means secured to said back portion and adapted for attachment to a vehicle frame structure.

5. An assembly as set forth in claim 2 including  
30 hood latch means secured to said back portion for cooperation with a vehicle hood.

6. An assembly as set forth in claim 2 wherein  
said energy absorber means has a cross-sectional U shape defining a base portion and two legs  
35 extending therefrom, said base portion of said energy absorber means disposed adjacent to said base portion of said mounting means.

7. An assembly as set forth in claim 6 including  
40 securing means for securing said energy absorber to said mounting means.

8. An assembly as set forth in claim 7 wherein  
said securing means includes a plurality of strap members extending between said tubular portions  
45 and being secured thereto.

9. An assembly as set forth in claim 8 wherein  
45 said energy absorber means includes at least one recessed portion extending thereinto at a distance equal to the forward extremity of said tubular portions said strap members extending through  
50 said recessed portions.

10. An assembly as set forth in claim 9  
including an elongated shell disposed adjacent  
said mounting means and about said energy  
absorber means.

11. An assembly as set forth in claim 10  
55 wherein said energy absorber means comprises an elastomeric material.

12. An assembly as set forth in claim 11  
wherein said mounting means comprises formed  
sheet metal components defining said tubular  
60 portions with two layers of engaging sheet metal defining said back portion, said tubular portions  
extending forwardly from said back portion.

13. An assembly as set forth in claim 12

metal of said back portion and a second leg (46)  
integral with a second of said layers of sheet metal  
of said back portion.

14. An assembly as set forth in claim 13  
70 wherein each of said tubular portions includes a first leg fixedly secured to a first of said layers of sheet metal of said back portion and a second leg  
integral with a second of said layers of sheet  
metal of said back portion.

15. An assembly as set forth in claim 14  
75 wherein said first layer of sheet metal of said back portion includes a flange extending from each end thereof, said first leg of each of said tubular  
portions being fixedly secured to a corresponding  
80 one of said flanges.

16. An assembly as set forth in claim 14  
wherein each of said first legs of said tubular  
portions includes a flange extending therefrom,  
said flanges being fixedly secured to said first layer  
85 of sheet metal of said back portion.

17. An assembly as set forth in claim 11  
wherein said securing means includes a tack  
disposed within said base portion of said energy  
absorber means and extending therefrom, said  
90 back portion of said mounting means having holes therethrough, said tack extending through said  
hole for providing additional securement of said  
energy absorber means to said mounting means.

18. An assembly as set forth in claim 11  
95 wherein said securing means includes a plate member disposed in said base portion of said  
energy absorber means said plate member having  
fastening means extending through said energy  
absorber means for further securing said energy  
100 absorber means to said mounting means.

19. An assembly as set forth in claim 12  
wherein one of said layers of sheet metal of said  
back portion includes integral ridges extending  
longitudinally for providing structural  
105 reinforcement.

20. A vehicle assembly consisting of; two  
spaced longitudinal frame members elongated  
mounting means directly connected to said frame  
members for being an integral part of said vehicle  
110 support frame assembly, energy absorber means  
for absorbing impact energy, said energy  
absorbing means being connected to said  
mounting means for support thereby, and  
characterized by said mounting means including  
115 two vertically spaced and interconnected hollow  
tubular portions each of said tubular portions  
having a closed cross section and extending along  
the length of said mounting means for providing  
structural rigidity and minimal deflection under  
120 impact loads whereby said mounting means forms  
part of the vehicle support frame structure while  
directly supporting the energy absorber means.

21. An assembly as set forth in claim 20  
wherein said mounting means includes a back  
portion extending between and interconnecting  
said tubular portions said energy absorber means  
125 engaging said back portion and extending  
vertically between and engaging said tubular

said tubular portions said back portion being directly connected to said members.

22. An assembly as set forth in claim 21 including hood latch means secured to said back  
5 portion for latching cooperation with a vehicle

hood.

23. A vehicle bumper assembly substantially as herein described and shown in the accompanying drawings.

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